

WHAT IS CLAIMED IS:

1. A hydraulic control system for an automatic transmission with a wet clutch serving as a start element and points to be lubricated, comprising:
 - a lubrication passage which feeds a lubricating oil to the wet clutch
 - 5 and the points of the transmission;
 - a first passage with a large-diameter orifice;
 - a second passage with a small-diameter orifice,
 - the first and second passages being arranged upstream of the lubrication passage;
 - 10 a switching valve which switches fluid communication between the lubrication passage and the first and second passages;
 - a distribution controller which controls the switching valve; and
 - an electronic control unit (ECU) which controls the distribution controller.
 - 15
2. The hydraulic control system as claimed in claim 1, further comprising:
 - a third passage arranged upstream of the first and second passages;
 - and
 - a cooler arranged on the third passage, the cooler cooling down the
 - 20 lubricating oil.
3. The hydraulic control system as claimed in claim 1, wherein the ECU is programmed to:
 - determine whether or not a vehicle is at a standstill;
 - 25 determine, when the vehicle is at a standstill, whether or not a temperature of the lubricating oil is equal to or smaller than a first predetermined temperature; and
 - control, when the temperature is equal to or smaller than the first predetermined temperature, the distribution controller to control the switching
 - 30 valve so as to shut off fluid communication between the lubrication passage

and the first and second passages.

4. The hydraulic control system as claimed in claim 3, wherein the ECU is further programmed to:

5 determine, when the temperature is greater than the first predetermined temperature, whether or not the temperature of the lubricating oil is equal to or smaller than a second predetermined temperature which is greater than the first predetermined temperature;

calculate, when the temperature is equal to or smaller than the second predetermined temperature, a supply ratio of the lubricating oil in accordance with the temperature; and

control, in accordance with the calculated supply ratio, the distribution controller to control the switching valve so as to provide intermittent fluid communication between the lubrication passage and the second passage.

15

5. The hydraulic control system as claimed in claim 4, wherein the ECU is further programmed to:

control, when the temperature is greater than the second predetermined temperature, the distribution controller to control the switching valve so as to provide fluid communication between the lubrication passage and the second passage.

20

6. The hydraulic control system as claimed in claim 3, wherein the ECU is further programmed to:

25 determine, when the vehicle is running, whether or not the wet clutch is in engagement; and

control, when the wet clutch is in engagement, the distribution controller to control the switching valve so as to provide fluid communication between the lubrication passage and the second passage.

30

7. The hydraulic control system as claimed in claim 6, wherein the ECU is further programmed to:

control, when the wet clutch is in slippage, the distribution controller to control the switching valve so as to provide fluid communication between the lubrication passage and the first passage.

8. The hydraulic control system as claimed in claim 1, wherein the distribution controller comprises one of a duty solenoid and a linear solenoid.

9. The hydraulic control system as claimed in claim 1, wherein the wet clutch comprises an electromagnetic multiple disc clutch comprising a pilot clutch engaged by an electromagnetic force of an electromagnet, a torque cam mechanism for converting an engaging force of the pilot clutch into an axial thrust force, and a main clutch engaged by the axial thrust force of the torque cam mechanism, the system further comprising:

a lubrication system for the electromagnetic multiple disc clutch, the lubrication system comprising a first portion for the electromagnet and a bearing arranged in the vicinity thereof, and a second portion for clutch plates of the pilot clutch and the main clutch,

wherein the lubrication passage is connected to the second portion of the lubrication system.

10. The hydraulic control system as claimed in claim 2, further comprising:
a pressure regulator valve arranged on the third passage upstream of the cooler, the pressure regulator valve regulating a pressure of the lubricating oil; and

a pressure controller which controls the pressure regulator valve in accordance with a command of the ECU.

11. The hydraulic control system as claimed in claim 10, wherein the ECU

is programmed to:

determine whether or not a temperature of the lubricating oil is equal to or smaller than a predetermined temperature; and

control, when the temperature is equal to or smaller than the
5 predetermined temperature, the pressure controller to set a pressure of the pressure regulator valve at a first value which is smaller than a predetermined value.

12. The hydraulic control system as claimed in claim 11, wherein the ECU
10 is further programmed to:

determine, when the temperature is greater than the predetermined temperature, whether or not the wet clutch is in engagement; and

control, when the wet clutch is in slippage, the pressure controller to
set the pressure of the pressure valve at a second value which is greater than
15 the predetermined value.

13. The hydraulic control system as claimed in claim 12, wherein the switching valve is arranged downstream of the cooler.

20 14. The hydraulic control system as claimed in claim 13, wherein the switching valve has a ratio for the lubricating oil distributed between the wet clutch and the points of the transmission, the ratio being switched between at least two values.

25 15. The hydraulic control system as claimed in claim 14, wherein the ECU is further programmed to:

control, when the wet clutch is in one of engagement and non-engagement, the distribution controller to set the ratio of the switching valve at a smaller one of the at least two values.

16. The hydraulic control system as claimed in claim 14, wherein the ECU is further programmed to:

control, when the wet clutch is in slippage, the distribution controller to set the ratio of the switching valve at a greater one of the at least two values.

5

17. A hydraulic control system for an automatic transmission with a wet clutch serving as a start element and points to be lubricated, comprising:

a lubrication passage which feeds a lubricating oil to the wet clutch and the points of the transmission;

10 a switching valve which switches fluid communication to the wet clutch and the points of the transmission;

a distribution controller which controls the switching valve;

a cooler arranged on the lubrication passage, the cooler cooling down the lubricating oil;

15 a pressure regulator valve arranged on the lubrication passage upstream of the cooler, the pressure regulator valve regulating a pressure of the lubricating oil;

a pressure controller which controls the pressure regulator valve; and

20 an electronic control unit (ECU) which controls the distribution controller and the pressure controller.

18. A method of controlling a hydraulic system for an automatic transmission with a wet clutch serving as a start element and points to be lubricated, the system comprising:

25 a lubrication passage which feeds a lubricating oil to the wet clutch and the points of the transmission;

a first passage with a large-diameter orifice;

a second passage with a small-diameter orifice,

30 the first and second passages being arranged upstream of the lubrication passage;

a switching valve which switches fluid communication between the lubrication passage and the first and second passages; and

a distribution controller which controls the switching valve,
the method comprising:

5 determining whether or not a vehicle is at a standstill;

determining, when the vehicle is at a standstill, whether or not a temperature of the lubricating oil is equal to or smaller than a first predetermined temperature; and

controlling, when the temperature is equal to or smaller than the first
10 predetermined temperature, the distribution controller to control the switching valve so as to shut off fluid communication between the lubrication passage and the first and second passages.

19. The method as claimed in claim 18, further comprising:

15 determining, when the temperature is greater than the first predetermined temperature, whether or not the temperature of the lubricating oil is equal to or smaller than a second predetermined temperature which is greater than the first predetermined temperature; and

calculating, when the temperature is equal to or smaller than the
20 second predetermined temperature, a supply ratio of the lubricating oil in accordance with the temperature; and

controlling, in accordance with the calculated supply ratio, the distribution controller to control the switching valve so as to provide intermittent fluid communication between the lubrication passage and the
25 second passage.

20. The method as claimed in claim 19, further comprising:

controlling, when the temperature is greater than the second predetermined temperature, the distribution controller to control the switching
30 valve so as to provide fluid communication between the lubrication passage

and the second passage.

21. The method as claimed in claim 18, further comprising:

5 determining, when the vehicle is running, whether or not the wet clutch
is in engagement; and
determining whether or not the wet clutch is in engagement; and
controlling, when the wet clutch is in engagement, the distribution
controller to control the switching valve so as to provide fluid communication
between the lubrication passage and the second passage.

10

22. The method as claimed in claim 21, further comprising:

controlling, when the wet clutch is in slippage, the distribution
controller to control the switching valve so as to provide fluid communication
between the lubrication passage and the first passage.

15

23. A method of controlling a hydraulic system for an automatic
transmission with a wet clutch serving as a start element and points to be
lubricated, the system comprising:

20 a lubrication passage which feeds a lubricating oil to the wet clutch
and the points of the transmission;

a switching valve which switches fluid communication to the wet clutch
and the points of the transmission;

a distribution controller which controls the switching valve;

25 a cooler arranged on the lubrication passage, the cooler cooling down
the lubricating oil;

a pressure regulator valve arranged on the lubrication passage
upstream of the cooler, the pressure regulator valve regulating a pressure of
the lubricating oil; and

30 a pressure controller which controls the pressure regulator valve,
the method comprising:

determining whether or not a temperature of the lubricating oil is equal to or smaller than a predetermined temperature; and

controlling, when the temperature is equal to or smaller than the predetermined temperature, the pressure controller to set a pressure of the pressure regulator valve at a first value which is smaller than a predetermined value.

24. The method as claimed in claim 23, further comprising:

determining, when the temperature is greater than the predetermined temperature, whether or not the wet clutch is in engagement; and

controlling, when the wet clutch is in slippage, the pressure controller to set the pressure of the pressure valve at a second value which is greater than the predetermined value.

25. The method as claimed in claim 24, wherein the switching valve has a ratio for the lubricating oil distributed between the wet clutch and the points of the transmission, the ratio being switched between at least two values, the method further comprising:

controlling, when the wet clutch is in one of engagement and non-engagement, the distribution controller to set the distribution ratio of the switching valve at a smaller one of the at least two values.

26. The method as claimed in claim 25, further comprising:

controlling, when the wet clutch is in slippage, the distribution controller to set the distribution ratio of the switching valve at a greater one of the at least two values.